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YIELD TABLES FOR CUT-OVER SPRUCE-FIR STANDS IN THE NORTHEAST

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1/ Maintained in New Haven, Connecticut, in cooperation with Yale University

YIELD TABLES FOR CUT-OVER SPRUCE-FIR STANDS IN THE NORTHEAST

For timberland owners interested in growing timber as a long term investment it is essential to be able to predict with reasonable accuracy future timber yields from lands of differing productivity. This is particularly true in the spruce region of the Northeast where vast timberlands are being operated for pulpwood production. Because of the depletion of old growth timber in this region with accompanying increased demand for pulpwood, the problem of adequate timber supplies has become a matter of serious concern. Thus, questions relating to future supplies and prospective pulpwood yields have become important considerations in the economy of the industry.

Studies of yield of spruce and fir have been restricted largely to pure even-aged fully stocked stands of these species. By far the greater part of the spruce region, however, consists of a mixed growth of spruce and fir with northern hardwoods and other species. Application of the normal yield tables developed for pure spruce-fir stands, to mixed spruce-hardwood stands, with a correction factor for hardwoods, leads consistently to gross errors. With this situation in mind an effort was made through the statistical method to develop a predicting mechanism which can be applied satisfactorily to the areas of mixed spruce-hardwoods so common to the region.

Basis of Study

The basic data used in developing suitable growth equations consisted of approximately 400 1/8 acre plots established throughout the spruce region of the Northeast. Areas selected for the study include cuttings ranging up to 60 years of age and include a wide range in composition and growing conditions. On most of these areas clear cutting of conifer pulpwood species had been practiced; that is, spruce and fir down to 6 or 8 inches d.b.h. had been removed while the hardwoods occurring in mixture were left intact.

Factors Influencing Growth Rate

Of the many factors influencing growth and yield of spruce and fir following clear cutting operations forest type or site, elapsed time since cutting, stand density, and composition, are the most important. The first of these factors, forest site, as reflected in forest types, was recognized by treating the data on the basis of two broad spruce types, (1) dominant softwood sites, and (2) secondary softwood sites. Thus, all plots were segregated into the above two classifications, each group of plots providing the basis for developing a separate set of yield tables.

Method used in this Study

To measure accurately the combined influences of the three factors, elapsed time, density, and composition on yield, the standard multiple correlation method of analysis was used. The basic formula developed for expressing yield follows:

$$V = T + \frac{N_c + N_o}{N} + \frac{N_c}{N_c + N_o}$$

V = Volume of spruce and fir

T = Time since cutting

N_c = Number of conifers

N_o = Number of other species

N = Number of trees taken from density curve

Using the regression equations evolved for the two broad types, an alignment chart for each type was constructed and used for calculating the yields shown in the accompanying tables. However, since the equations present values for the entire softwood stand, i.e. for all spruce and fir in and above the 1-inch diameter class, merchantable yields in cords per acre were calculated through the application of proper conversion factors.

Predicting Growth

To use the equations and yield tables for determination of future pulpwood yields it is essential to make a survey of the tract in question as outlined below.

1. Classification of the area into:

   (a) Dominant softwood sites. Areas supporting a high proportion of conifers. These sites are made up largely of the following forest types (1) spruce swamp, (2) spruce slope, (3) old field spruce, (4) red spruce-balsam fir-paper birch, and (5) red spruce-yellow birch. The hardwoods occurring in mixture with conifers in these stands consist principally of paper birch, aspen, yellow birch, and red maple. These sites are usually encountered in swamps, flats, and high slopes.

   (b) Secondary softwood sites. Areas supporting a strong admixture of hardwoods. These sites are made up mainly of the red spruce-sugar maple-beech type along with some of the better drained sites in the red spruce-yellow birch type. On these sites beech, sugar maple, and yellow birch are the hardwoods commonly found in mixture with spruce and fir. Secondary softwood sites usually occur along low ridges and in the better drained lower slopes.

2. Classification of sites by age of cuttings. Ascertain as nearly as possible the elapsed period since cutting for the various units on the areas, classifying cuttings 3 to 7 as 5 year cuttings, those 8 to 12 as 10 year cuttings, etc.

3. Stand tallies. On fractional acre plots established at regular intervals along the grid lines which form the basis of most forest surveys, tree tallies should be recorded by dominant and secondary softwood sites and records kept separately for each age cutting. Since the quantity of sapling growth is an important factor in final yields, it is essential that a tally of all stems be made. This can be done most expeditiously by following the tally of trees in and above the 4-inch diameter class on the cruise plot with a tally of only the 1, 2, and 3-inch stems on a 1/50 acre plot located in the corner or center of the cruise plot.

On completion of the field survey a tabular summarization of the data should be made showing for each age cutting by site classes, separately for hardwoods, spruce-fir, and all species combined, the total number of trees and basal area per acre and the average diameters. These data are needed to calculate two factors, stand density and stand composition, which, as previously mentioned, strongly influence yield.

Determination of Stand Density

Relative density as here used is the percentage relationship between the number of trees per acre for a specific stand and the regional average number for the same average diameter. The basic relationship between number of trees and their average diameter is shown in Table 1 based on the 400 region-wide plots comprising the study. The average number of trees per acre for different average diameters shown in the table for empirically stocked stands may be considered as representing 100 percent. Then the relative density of an individual stand is its number of trees expressed as a percentage of the tabular values for the same diameter. This contrasts with the Reineke 1/ stand density index concept which shows the progression of number of trees and diameter under conditions of uniform stocking, whereas the relative density concept employs the relation of number of trees and diameter which is modified by the empirical change in density.

1/ Reineke, L.H. Perfecting a Stand Density Index for Even-aged Forests, Journ. Agr. Research, Vol. 46, pp. 627-638, 1933.

Determination of Composition Index

In predicting future yields of spruce and fir it is necessary to know the composition index. This can be calculated easily since it is based on the relationship of the number of spruce and fir trees to the total number of all tree species in the stand. Thus, to obtain the composition index of any spruce stand merely divide the total number of spruce and fir by the total number of all trees in the stand.

Determination of Elapsed time since Cutting

Often maps or office records will reveal the cutting dates of different parcels of land comprising an ownership block. Where this information is lacking it should be determined in conjunction with the forest survey. Date of cutting can usually be determined within a year or two by counting the annual growth rings on rapid growing hardwoods which spring up in skid roads and skid trails the first growing season following logging. Increment borings from trees, having well-developed crowns, a few feet distant from a stump will often furnish a reliable clue to the cutting date, since these trees customarily show accelerated growth.

Example of Predicted Yields

Having determined the density of a given stand, its composition index, and the number of years since it was cut, it is possible now to calculate the expected future yield. Illustrated below are the steps and computations involved in a typical case calling for the estimated yield in cords of spruce and fir 50 years hence on a tract clearcut for spruce and fir ten years ago.

Stand conditions

Area	865 acres
Site	Dominant softwood
Stand per acre 1" d.b.h. and larger	
(1) Spruce and fir	512 trees
(2) Hardwoods and others	192 "
(3) All trees	704 "
Basal area	31.36 square feet
Average d.b.h.	2.9 inches
Age of cutting	10 years

Computations

Density -- 704 (total number of trees in the stand) divided by 1100 (number of trees indicated in the reference table for an average diameter of 2.9 inches) = 0.64 x 100 = 64.

Composition -- 512 (total number of spruce and fir) divided by 704 (total of all trees) = 0.73 x 100 = 73.

Elapsed time since cutting -- 10 (age of cutting) plus 50 (number of years hence for which predicted yield is desired) = 60.

Yield tables prepared for dominant softwood sites show that for a stand with a density of 64 and a composition index of 73, estimated spruce fir yields 60 years after cutting will approximate 12.5 cords per acre. Thus, the total merchantable volume present on the 865 acre tract 50 years hence, or 60 years after cutting, should approximate 10,812 cords (865 x 12.5 = 10,812).

Accuracy of Yield Tables

Absolute accuracy is not claimed for these yield tables. Actual yields in some instances diverge widely from tabular values, particularly where applied to small areas. For example, the standard deviations of measured values for individual 1/8-acre plots from the tabular values, computed separately for dominant and secondary softwood sites, are ± 54.05 and ± 66 percent respectively. These differences may be due in part to variations in degree of cutting and quantity and distribution of advance spruce and fir reproduction, factors which influence to a marked degree the quantity of effective growing stock, or to some special condition such as partial utilization of hardwoods and girdling or weeding operations subsequent to cutting. However, while 1/8-acre units may deviate widely from the yield tables, the error in the mean of 800 such units, or 100 acres, would not be expected to exceed 3.8 or 4.7 percent respectively for dominant and secondary softwood sites more than once in 20 times.

The ultimate measure of accuracy of prediction of these tables must await the accumulation and analysis of observations on permanent sample plots over a reasonable interval of time. Until so checked, the accuracy of the tables themselves must be presumed. Analysis in progress of remeasurement data over a 15-year period, on approximately 25 percent of the original 400 plots, is providing a fairly reliable basis for estimating the accuracy of the yield tables. The results of this analysis will be available in the course of the next few months. The accuracy of predictions by means of the tables, therefore, will depend and cannot exceed the accuracy of the basic data on which the predictions are made. This can be determined from the cruise data itself. If the standard deviation of the volumes of the cruise plots is computed and expressed as a percentage of the average volume, this value together with the number of cruise plots taken will indicate in Table 2 the limits of error which will not be exceeded more than once in twenty cases. Thus, if the standard deviation percent for a test series of 1/8-acre plots is computed to be 60, the expected limits of accuracy for 10 plots according to the table will be ± 38 percent. Increasing the number of plots to 100 should provide an accuracy of ± 12 percent.

Table No. 1.-- Reference curve table for determining stand density for dominant and secondary softwood sites

Average number of trees per acre for stands of varying average diameters as read from reference curve based on approximately 400 plots in various spruce types of the spruce-fir region of the Northeast

D.B.H. inches	D.B.H. tenths inches									
	.01	.1	.2	.3	.4	.5	.6	.7	.8	.9
	Number of trees									
1	1,660	1,625	1,590	1,560	1,530	1,500	1,465	1,435	1,405	1,375
2	1,345	1,315	1,285	1,260	1,230	1,200	1,175	1,150	1,125	1,100
3	1,075	1,050	1,025	1,000	975	950	930	910	890	870
4	850	830	815	800	782	765	748	732	716	700
5	685	670	655	640	625	610	595	582	569	555
6	543	530	518	506	495	485	474	462	452	442
7	433	424	415	406	398	391	384	376	367	360
8	352	344	337	330	323	316	309	302	296	290
9	283	276	269	263	257	251	246	240	235	230
10	225	220	215	210	205	200	195	191	187	183

N.B. To determine the density of any given spruce stand, divide the total number of trees per acre by the total number of trees indicated in the above table for the same average diameter stand.

TABLE No. 2.--Expected limits of cruise accuracy (2 SD_M)

Standard deviation of volume	Number of plots								
	10	25	50	75	100	150	200	250	300
(percent)									
10	6.30	4.00	2.83	2.31	2.00	1.63	1.41	1.27	1.15
20	12.7	8.00	5.66	4.62	4.00	3.26	2.83	2.53	2.31
30	19.0	12.0	8.49	6.93	6.00	4.90	4.24	3.80	3.46
40	25.3	16.0	11.3	9.20	8.00	6.53	5.66	5.06	4.62
50	31.6	20.0	14.1	11.5	10.0	8.16	7.07	6.33	5.77
60	38.0	24.0	17.0	13.9	12.0	9.80	8.49	7.59	6.93
70	44.3	28.0	19.8	16.2	14.0	11.4	9.90	8.86	8.08
80	50.6	32.0	22.6	18.5	16.0	13.1	11.3	10.1	9.23
90	57.0	36.0	25.5	20.8	18.0	14.7	12.7	11.4	10.4
100	63.3	40.0	28.3	23.1	20.0	16.3	14.1	12.7	11.5
110	69.6	44.0	31.1	25.4	22.0	18.0	15.6	13.9	12.7
120	75.9	48.0	33.9	27.7	24.0	19.6	17.0	15.2	13.9
130	82.3	52.0	36.8	30.0	26.0	21.2	18.4	16.4	15.0
140	88.6	56.0	39.6	32.3	28.0	22.9	19.8	17.7	16.2
150	94.9	60.0	42.4	34.6	30.0	24.5	21.2	19.0	17.3

TABLE No. 3. SECONDARY SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class

10 years after cutting

Density (Percent)	Composition Index (Percent)								
	10	20	30	40	50	60	70	80	90
	Volume in cords								
10	.1	.2	.3	.4	.5	.5	.5	.5	.5
20	.1	.3	.4	.5	.6	.6	.6	.6	.6
30	.1	.3	.5	.6	.6	.7	.7	.7	.7
40	.2	.4	.5	.7	.8	.8	.8	.8	.8
50	.3	.4	.6	.8	.9	.9	.9	.9	.9
60	.3	.5	.7	.9	1.0	1.0	1.0	1.0	1.0
70	.4	.6	.9	1.0	1.1	1.1	1.2	1.2	1.2
80	.4	.7	1.0	1.2	1.3	1.3	1.3	1.3	1.3
90	.5	.8	1.1	1.4	1.5	1.5	1.5	1.6	1.6
100	.6	.9	1.3	1.6	1.8	1.8	1.9	1.9	1.9
110	.7	1.1	1.5	1.9	2.2	2.2	2.3	2.3	2.3
120	.8	1.2	1.8	2.4	2.9	3.0	3.1	3.1	3.2
130	.9	1.4	2.2	3.3	3.7	3.8	3.9	4.0	4.0
140	1.1	1.7	2.8	4.1	4.5	4.6	4.7	4.7	4.7
150	1.3	2.1	3.7	4.8	5.1	5.2	5.3	5.3	5.3

TABLE No. 3. SECONDARY SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

20 years after cutting

Density (Percent)	Composition Index (Percent)								
	10	20	30	40	50	60	70	80	90
	Volume in cords								
10	.2	.4	.6	.8	.8	.8	.9	.9	.9
20	.3	.5	.7	.9	.9	1.0	1.0	1.0	1.0
30	.4	.6	.8	1.0	1.1	1.1	1.1	1.1	1.1
40	.4	.7	.9	1.1	1.2	1.3	1.3	1.3	1.3
50	.5	.8	1.1	1.3	1.4	1.5	1.5	1.5	1.5
60	.6	.9	1.2	1.6	1.7	1.7	1.8	1.8	1.8
70	.7	1.0	1.4	1.9	2.1	2.1	2.2	2.2	2.2
80	.8	1.2	1.7	2.3	2.6	2.7	2.8	2.9	2.9
90	.9	1.4	2.1	3.0	3.5	3.6	3.7	3.7	3.8
100	1.1	1.6	2.6	3.9	4.3	4.4	4.5	4.5	4.6
110	1.2	2.0	3.5	4.7	5.0	5.0	5.1	5.1	5.2
120	1.4	2.4	4.3	5.2	5.5	5.5	5.6	5.6	5.7
130	1.6	3.2	5.0	5.7	5.9	6.0	6.0	6.1	6.1
140	1.9	4.1	5.5	6.1	6.3	6.4	6.4	6.4	6.5
150	2.4	4.8	5.9	6.5	6.7	6.7	6.6	6.8	6.8

TABLE No. 3. SECONDARY SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class--Continued

30 years after cutting

Density (Percent)	Composition Index (Percent)								
	10	20	30	40	50	60	70	80	90
	Volume in cords								
10	.5	.8	1.0	1.3	1.4	1.4	1.4	1.4	1.5
20	.6	.9	1.2	1.5	1.6	1.7	1.7	1.7	1.7
30	.7	1.0	1.4	1.8	2.0	2.0	2.1	2.1	2.1
40	.8	1.2	1.6	2.2	2.4	2.5	2.6	2.7	2.7
50	.9	1.3	1.9	2.8	3.3	3.4	3.5	3.5	3.6
60	1.0	1.5	2.4	3.7	4.1	4.2	4.3	4.4	4.4
70	1.2	1.9	3.2	4.5	4.8	4.9	5.0	5.0	5.0
80	1.3	2.3	4.1	5.1	5.4	5.4	5.5	5.5	5.5
90	1.5	3.0	4.8	5.6	5.8	5.9	5.9	5.9	6.0
100	1.9	3.9	5.4	6.0	6.2	6.3	6.3	6.3	6.4
110	2.3	4.8	5.8	6.4	6.6	6.6	6.7	6.7	6.7
120	3.0	5.2	6.2	6.8	6.9	7.0	7.0	7.0	7.1
130	4.0	5.7	6.6	7.1	7.2	7.3	7.3	7.3	7.3
140	4.7	6.1	6.9	7.4	7.5	7.6	7.6	7.6	7.6
150	5.3	6.5	7.2	7.7	7.8	7.9	7.9	7.9	7.9

TABLE No. 3. SECONDARY SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class --Continued

40 years after cutting

Density (Percent)	Composition Index (Percent)								
	10	20	30	40	50	60	70	80	90
	Volume in cords								
10	.9	1.3	1.9	2.6	3.1	3.2	3.3	3.3	3.3
20	1.0	1.5	2.3	3.5	3.9	4.0	4.1	4.2	4.2
30	1.1	1.8	3.1	4.3	4.7	4.8	4.8	4.9	4.9
40	1.3	2.2	3.9	5.0	5.3	5.3	5.4	5.4	5.4
50	1.5	2.9	4.7	5.5	5.7	5.8	5.8	5.9	5.9
60	1.8	3.7	5.3	5.9	6.1	6.2	6.2	6.3	6.3
70	2.2	4.5	5.7	6.3	6.5	6.6	6.6	6.6	6.6
80	2.9	5.1	6.1	6.7	6.9	6.9	6.9	7.0	7.0
90	3.8	5.6	6.5	7.0	7.2	7.2	7.3	7.3	7.3
100	4.5	6.1	6.9	7.3	7.5	7.5	7.5	7.6	7.6
110	5.1	6.4	7.2	7.6	7.8	7.8	7.8	7.8	7.9
120	5.6	6.8	7.5	7.9	8.0	8.1	8.1	8.1	8.1
130	6.1	7.1	7.8	8.1	8.3	8.3	8.3	8.3	8.3
140	6.5	7.4	8.0	8.4	8.5	8.5	8.6	8.6	8.6
150	6.8	7.7	8.3	8.6	8.7	8.8	8.8	8.8	8.8

TABLE NO. 3. SECONDARY SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

50 years after cutting

Density (Percent)	Composition Index (Percent)								
	10	20	30	40	50	60	70	80	90
	Volume in cords								
10	1.5	2.6	4.6	5.4	5.7	5.7	5.8	5.8	5.8
20	1.8	3.5	5.2	5.9	6.0	6.1	6.1	6.2	6.2
30	2.1	4.4	5.7	6.3	6.5	6.5	6.5	6.6	6.6
40	3.0	5.1	6.0	6.6	6.8	6.8	6.9	6.9	6.9
50	3.9	5.6	6.5	7.0	7.1	7.2	7.2	7.3	7.3
60	4.5	6.0	6.8	7.3	7.4	7.5	7.5	7.5	7.6
70	5.2	6.4	7.1	7.6	7.7	7.8	7.8	7.8	7.8
80	5.7	6.7	7.4	7.9	8.0	8.1	8.1	8.1	8.1
90	6.0	7.1	7.7	8.1	8.2	8.3	8.3	8.3	8.3
100	6.5	7.4	8.0	8.3	8.5	8.5	8.5	8.5	8.6
110	6.8	7.7	8.3	8.6	8.7	8.7	8.7	8.7	8.8
120	7.1	8.0	8.5	8.8	8.9	8.9	9.0	9.0	9.0
130	7.4	8.2	8.7	9.0	9.1	9.2	9.2	9.2	9.2
140	7.7	8.5	9.0	9.3	9.4	9.4	9.4	9.4	9.5
150	8.0	8.7	9.2	9.5	9.6	9.6	9.6	9.6	9.6

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class

10 years after cutting

Density (Percent)	Composition Index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10			.02	.3	.5	.8	1.2	1.5	1.9	2.3
30			.2	.5	.8	1.1	1.4	1.8	2.2	2.6
50	.04	.2	.4	.7	1.1	1.4	1.8	2.2	2.6	3.0
70	.2	.4	.7	1.0	1.3	1.7	2.1	2.5	2.9	3.4
90	.3	.6	.9	1.3	1.6	2.0	2.4	2.9	3.3	3.8
110	.6	.9	1.2	1.6	2.0	2.4	2.8	3.2	3.7	4.1
130	.8	1.2	1.5	1.9	2.3	2.7	3.2	3.6	4.1	4.5
150	1.1	1.5	1.9	2.2	2.7	3.1	3.5	4.0	4.4	4.9
170	1.4	1.8	2.2	2.6	3.0	3.5	3.9	4.4	4.8	5.3
190	1.7	2.1	2.5	3.0	3.4	3.8	4.3	4.8	5.2	5.7
210	2.1	2.5	2.9	3.3	3.8	4.2	4.7	5.2	5.6	6.1
230	2.4	2.8	3.3	3.7	4.2	4.6	5.1	5.6	6.1	6.5
250	2.8	3.2	3.6	4.1	4.5	5.0	5.5	6.0	6.5	7.0

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

20 years after cutting

Density (Percent)	Composition Index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	.6	.9	1.3	1.6	2.0	2.4	2.8	3.3	3.7	4.2
30	.9	1.2	1.6	1.9	2.3	2.8	3.2	3.6	4.1	4.6
50	1.1	1.5	1.9	2.3	2.7	3.1	3.6	4.0	4.5	5.0
70	1.4	1.8	2.2	2.6	3.1	3.5	3.9	4.4	4.9	5.4
90	1.7	2.1	2.6	3.0	3.4	3.9	4.3	4.8	5.3	5.8
110	2.1	2.5	2.9	3.4	3.8	4.3	4.7	5.2	5.7	6.2
130	2.4	2.9	3.3	3.7	4.2	4.6	5.1	5.6	6.1	6.6
150	2.8	3.2	3.7	4.1	4.6	5.0	5.5	6.0	6.5	7.0
170	3.2	3.6	4.0	4.5	5.0	5.4	5.9	6.4	6.9	7.4
190	3.5	4.0	4.4	4.9	5.4	5.8	6.3	6.8	7.3	7.9
210	3.9	4.3	4.8	5.3	5.8	6.3	6.7	7.3	7.8	8.3
230	4.3	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7
250	4.7	5.2	5.6	6.1	6.7	7.1	7.6	8.2	8.7	9.2

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- continued

30 years after cutting

Density (Percent)	Composition Index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	2.1	2.5	3.0	3.4	3.8	4.3	4.7	5.2	5.7	6.2
30	2.5	2.9	3.3	3.8	4.2	4.7	5.1	5.6	6.1	6.6
50	2.8	3.2	3.7	4.1	4.6	5.1	5.5	6.0	6.5	7.0
70	3.2	3.6	4.1	4.5	5.0	5.5	6.0	6.5	7.0	7.5
90	3.6	4.0	4.5	4.9	5.4	5.9	6.4	6.9	7.4	7.9
110	3.9	4.4	4.9	5.3	5.8	6.3	6.8	7.3	7.8	8.3
130	4.3	4.8	5.3	5.7	6.2	6.7	7.2	7.7	8.3	8.8
150	4.7	5.2	5.7	6.1	6.7	7.1	7.7	8.2	8.7	9.2
170	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.6	9.2	9.7
190	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.1	9.6	10.1
210	5.9	6.4	6.9	7.4	7.9	8.5	9.0	9.6	10.1	10.6
230	6.3	6.8	7.3	7.9	8.4	8.9	9.5	10.0	10.6	11.0
250	6.8	7.3	7.8	8.3	8.8	9.4	9.9	10.5	11.0	11.5

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

40 years after cutting

Density (Percent)	Composition index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	3.9	4.4	4.9	5.4	5.9	6.3	6.8	7.3	7.9	8.4
30	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.8	8.3	8.8
50	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.3
70	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.7	9.2	9.7
90	5.5	6.0	6.5	7.0	7.5	8.1	8.6	9.1	9.7	10.2
110	6.0	6.5	6.9	7.5	8.0	8.5	9.0	9.6	10.1	10.7
130	6.4	6.9	7.4	7.9	8.4	9.0	9.5	10.0	10.6	11.1
150	6.8	7.3	7.8	8.3	8.9	9.4	10.0	10.5	11.0	11.6
170	7.2	7.7	8.3	8.8	9.3	9.9	10.4	11.0	11.5	12.1
190	7.7	8.2	8.7	9.2	9.8	10.3	10.9	11.4	12.0	12.5
210	8.1	8.6	9.1	9.7	10.3	10.8	11.3	11.9	12.5	13.0
230	8.5	9.1	9.6	10.2	10.7	11.3	11.8	12.4	13.0	13.5
250	9.0	9.6	10.1	10.6	11.2	11.7	12.3	12.9	13.4	14.0

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

50 years after cutting

Density (Percent)	Composition Index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	6.0	6.5	7.0	7.5	8.0	8.5	9.1	9.6	10.2	10.7
30	6.4	6.9	7.4	7.9	8.4	9.0	9.5	10.1	10.6	11.2
50	6.8	7.3	7.8	8.4	8.9	9.4	10.0	10.5	11.1	11.7
70	7.2	7.8	8.3	8.8	9.4	9.9	10.5	11.0	11.6	12.1
90	7.7	8.2	8.7	9.3	9.8	10.4	10.9	11.5	12.0	12.6
110	8.1	8.7	9.2	9.7	10.3	10.8	11.4	11.9	12.5	13.1
130	8.6	9.1	9.7	10.2	10.7	11.3	11.9	12.4	13.0	13.6
150	9.0	9.6	10.1	10.7	11.2	11.7	12.3	12.9	13.5	14.1
170	9.5	10.0	10.6	11.1	11.7	12.2	12.8	13.4	14.0	14.6
190	9.9	10.5	11.0	11.6	12.1	12.7	13.3	13.9	14.5	15.1
210	10.4	10.9	11.5	12.1	12.6	13.2	13.8	14.4	15.0	15.6
230	10.9	11.4	12.0	12.5	13.1	13.7	14.3	14.9	15.5	16.1
250	11.3	11.9	12.5	13.1	13.6	14.2	14.8	15.4	16.0	16.6

TABLE NO. 4. DOMINANT SOFTWOOD SITES: Volume of spruce and fir in cords per acre of all trees in and above the 6-inch diameter class -- Continued

60 years after cutting

Density (Percent)	Composition Index (Percent)									
	10	20	30	40	50	60	70	80	90	100
	Volume in cords									
10	8.2	8.7	9.2	9.8	10.3	10.8	11.4	12.0	12.5	13.1
30	8.6	9.1	9.7	10.2	10.8	11.3	11.9	12.5	13.0	13.6
50	9.1	9.6	10.1	10.7	11.2	11.8	12.4	12.9	13.5	14.1
70	9.5	10.1	10.6	11.1	11.7	12.3	12.9	13.4	14.0	14.6
90	10.0	10.5	11.1	11.6	12.2	12.8	13.3	13.9	14.5	15.1
110	10.4	11.0	11.5	12.1	12.7	13.3	13.8	14.4	15.0	15.6
130	10.9	11.4	12.0	12.6	13.2	13.7	14.3	14.9	15.5	16.1
150	11.4	11.9	12.5	13.1	13.7	14.3	14.8	15.4	16.0	16.6
170	11.8	12.4	13.0	13.6	14.2	14.7	15.3	15.9	16.5	17.1
190	12.3	12.9	13.5	14.1	14.7	15.3	15.8	16.4	17.0	17.6
210	12.8	13.4	14.0	14.6	15.2	15.7	16.3	16.9	17.5	18.1
230	13.3	13.9	14.5	15.1	15.7	16.3	16.8	17.4	18.0	18.6
250	13.8	14.4	15.0	15.6	16.2	16.7	17.4	17.9	18.5	19.1